

Application for Letters Patent
of the UNITED STATES OF AMERICA by -

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For:

A METHOD AND AN APPARATUS FOR PACKAGING OBJECTS

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BACKGROUND OF THE INVENTION

The invention relates to a method for packaging objects using a hose-shaped stretch foil, guided in run-like manner as hose of lateral folds in particular, in accordance with the preamble of patent claim 1 as well as to an apparatus for packaging objects in accordance with the preamble of patent claim 8. Such apparatuses and methods are used in particular for packaging stacks of goods arranged on pallets in order to give protection to the stack of goods during transport against humidity and other environmental influences in case of using a foil hood. Moreover, the wrapping of said stack of goods with a foil hood or a band stock allots increased stability to the packaging unit, since the foil hood and/or band stock is stretched in horizontal and vertical direction when pulled over the stack of goods and after having been pulled over bears on said stack of goods and said pallet with tension.

From DE 39 21 190 C2 an apparatus is known for packaging objects in a hose-shaped plastic foil, in which a foil hood is reefed on gripper means arranged on a vertical frame. Subsequently, said gripper means are moved apart in horizontal direction, this stretching the foil hood in horizontal direction. Shafts adjustable with respect to said gripper means and driven are provided for on said frames and a continuously circulating band which is in contact with the outer surface of the shaft is arranged on each gripper means, Due to the rotational movement of the shaft in one direction, the foil can be pushed onto

the gripper means. During the subsequent pulling-over of the foil hood over the stack of goods the foil hood can then be pulled down from the frame in controlled manner by the rotation of the shaft in opposite direction. This apparatus permits control of the vertical stretch of the foil, however, it turns out to be disadvantageous in this apparatus that the horizontal stretch of the foil on the upper surface of the objects to be packed is not sufficient. Consequently, excess stretching of the foil hood can be created when the gripper means move apart after pushing over of the foil and stretch the foil hood horizontally. Thus, in those positions of the foil hood, in which the grippers engage with the hood and expand the latter, thin portions of the foil hood are created, i.e. endangered portions in particular in the corners of the stack of goods to be packaged. This problem can be avoided in known manner in that the gripper bows have a substantial length and a broad bearing surface for the foil such that the expansion forces are distributed correspondingly. However, this solution has the disadvantage that the grippers for gripping the foil cannot be retracted to a small cross-section. Retraction to a cross-section as small as possible, however, is desired for reasons of space and is possible since the present-day foils permit high expansion even in case of low initial cross-sections of the hose.

The same problems result in case of a hose stretch open on top, so-called band stock, cut to a suitable length.

SUMMARY OF THE INVENTION

It is, therefore, the main object of the present invention to create a method as well as an apparatus for packaging objects, which avoid the excessive stretching of the foil hood or band stock, respectively, and formation of thinned foil portions in the area of the upper surface of the good to be packed.

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This object is solved by the method in accordance with claim 1 and by the apparatus in accordance with claim 8. Preferred embodiments of the invention are defined in the subclaims.

In the method in accordance with the present invention, for packaging objects the formed foil hood or band stock, respectively, is reefed onto several gripper means movable in essentially horizontal direction, of a lifting frame moveable in vertical direction. Subsequently, the pushed-on foil hood or band stock, respectively, is tented by the movement of said gripper means in the essentially horizontal direction such that said tented opening of said foil hood or band stock, respectively, is larger than the horizontal projection of the good to be packed and wherein said foil hood or band stock, respectively, is stretched in essentially horizontal direction. In a next step said foil hood or band stock, respectively, is pulled over said object by the essentially vertical movement of said lifting frame, said foil hood or band stock, respectively, being pulled off from said gripper means and being expanded in essentially vertical direction. The method in accordance with the present invention is characterized

in that the tension of said foil hood or band stock, respectively, on the upper side of the stack of goods is controlled. Hereby the horizontal stretch of said foil on the upper side of said good can be adjusted to the respective practical circumstances, to the contour of the stack of goods in particular, thereby avoiding excessive stretching and formation of thinned portions in said foil and simultaneously achieving good bearing of said stretched foil in the upper area of the good to be packed in particular.

In a preferred embodiment of the method, during tentering of said foil hood or band stock, respectively, said foil partially again is pulled off from said gripper means. Thereby it is made possible that a part of said foil again is released during said horizontal stretching operation. Thereby excessive stretching in areas with thin portions in said foil are avoided, which in particular occur in positions of said foil where said gripper means are located.

In another preferred embodiment of the present invention, the pulling-off speed of said foil during tentering of said foil hood or band stock, respectively, by controlled rolling down of said foil from said gripper means is less than the speed of horizontal movement of said gripper means. Thereby it is achieved that said foil hood or band stock, respectively, continues to be stretched during tentering, however, with respect to traditional apparatuses the degree of stretching is reduced in the corner areas in which said foil is pulled over the bow-shaped grippers such that excessive stretching in horizontal direction is avoided.

In order to achieve a good stretch in vertical direction during pulling-over of said foil hood or band stock, respectively, over said object on the pallet, in a further preferred embodiment said pulling-off speed of said foil during pulling-over is lower than the vertical speed of said lifting frame.

In a particularly preferred embodiment of the method in accordance with the present invention reefing or pulling-off of said foil hood or band stock, respectively, during reefing or tentering and/or pulling-off of said foil hood or band stock, respectively, during pulling-over is caused by the movement of rolls, the outer surfaces of said rolls shifting the portions of said foil hood or band stock, respectively, pushed onto said gripper means. Thereby, the reefing or pulling-off speed, respectively, of said foil hood or band stock, respectively, can be accurately controlled by the control of the speed of the rolls.

In a further embodiment the lower end of said foil hood or band stock, respectively, in the end phase of pulling-over is held for creating a maximum vertical stretch and an understretch such that the lower end of said foil hood or band stock, respectively, fixedly bears on the bottom side of the stack of goods on pallet. In a preferred embodiment holding of said foil hood or band stock, respectively, can be effected by the above-described rolls which press said foil hood or band stock, respectively, to said gripper means. However, also other means for holding said foil hood or band stock, respectively, can be provided for.

The apparatus in accordance with the present invention for packaging objects with a stretch foil includes a lifting frame movable in essentially vertical direction, for pulling-over said foil hood or band stock, respectively, over the stack of goods as well as gripper means provided for an said lifting frame, for gripping and expanding said foil hood or band stock, respectively, in essentially horizontal direction. Furthermore, on said gripper means reefing means for reefing and pulling-off said foil hood or band stock, respectively, from said gripper means are provided for. Said reefing means are characterized in that they comprise control means for controlling expansion of said foil hood or band stock, respectively, in the area of the upper side of said stack of goods, whereby a desired horizontal stretch of said foil can be adjusted and excessive stretching is avoided.

In a preferred embodiment said reefing means permit the partial pulling-off of said foil hood or band stock, respectively, from said gripper means during the essentially horizontal movement of said gripper means. Thereby, the horizontal stretch of said foil is reduced and thin positions in the foil, in particular in positions where said foil runs over the bow-shaped sections at the upper end of said grippers, are avoided.

In a preferred embodiment said control means can control the pulling-off speed during the essentially horizontal movement of said gripper means and/or the vertical movement of said lifting frame. The control therein is ef-

fectured in advantageous manner such that the pulling-off speed during the essentially horizontal movement of said gripper means is lower than the speed of said gripper means and/or that the pulling-off speed during the essentially vertical movement of said lifting frame is lower than the speed of said lifting frame. Hereby a certain degree of expansion of said foil hood or band stock, respectively, in vertical and horizontal directions is achieved.

In a further embodiment of said apparatus in accordance with the present invention said reefing means comprise at least one roll which can be brought to bear on said lifting frame and rolls up or rolls of said foil hood or band stock, respectively, onto or from said gripper means.

In order to achieve maximum understretch of said foil hood or band stock, respectively, in a further embodiment a holding means is provided for at each reefing means, for holding said foil at said gripper means during the pulling-over phase. Said holding means in an embodiment of the apparatus can be formed by the above-described rolls which press said foil hood or band stock, respectively, against said gripper means during the pulling-over end phase.

BRIEF DESCRIPTION OF DRAWINGS

Further features, advantages and details of the present invention result from the following detailed description of a preferred embodiment with reference to the attached drawing, wherein

FIG. 1 shows a perspective view of the essential parts of an apparatus for packaging objects in accordance with an embodiment of the present invention; and

FIGs. 2A to F show the individual steps of an embodiment of the method in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The apparatus shown in FIG. 1, for packaging objects 1 comprises a supply roll not shown, for a folded foil hose 3 which is unwound from said supply roll and fed to a central packaging unit. Said packaging unit comprises a frame which is moved in vertical direction over said stack of goods 1 for packaging said objects. Of said packaging unit only the components relevant for the invention are shown for better elucidation.

As can be seen from FIG. 1, said foil hose 3 is guided over a deflection rod 4 vertically in downward direction to a welding and cutting means 5 when a foil hood is to be formed. In said welding and cutting means said foil hose 3 is closed by welding at a desired length and is cut off and the end of said foil hose opposite to said welded end is reefed onto the four gripper means 8 provided for on said frame and subsequently is tensioned in horizontal direction by horizontal movement of said gripper means such that an opened foil hood 6 is created. Said gripper means shown in FIG. 1 consist of bow-like frame sections 8a and bow supports 8b. Said bow-like frame sections 8a and

said bow supports 8b are formed C-shaped and thus pre-define the corners of said foil hood. If creation of a foil hood closed on its upper side is not intended, said welding means can be done without and a hose piece (band stock) is cut to a given length. In the following, however, a foil hood is talked about.

Figs. 2A to 2E show the steps of the method in accordance with the present invention, for packaging said stack of goods 1 with said foil hood 6, wherein in the figures two gripper means 8 are shown respectively. As can be seen from the figures, a reefing means 9 is arranged on said gripper means respectively, which pushes said foil hood onto said respective gripper means or pulls it off therefrom. Said reefing means 9 includes a roll 10 as well as a drive 11. Said reefing means is fixed on a support 12 which again is arranged in a guide 14 and is horizontally shiftable. The bow piece of said gripper means 8 is fixed to an arm 13. Said arm also is arranged in said guide 14 and is shiftable in horizontal direction.

As is shown in FIG. 2A, after welding together and cutting off of said foil hood 6 reefing of the latter onto said gripper means 8 is carried out. For this purpose said arm 13 is moved into a position in which the cross section of said frame is smaller than the contour of said stack of goods. In addition, the outer surfaces of said rolls 10 come into contact with the outsides of said foil hood. By rotating said roll of said left-hand gripper means in clockwise direction and rotating said roll of said right-hand gripper means in counterclockwise direction (as indicated by the arrows in FIG. 2A) now said foil hood can be reefed onto

said bow-like frame section of said gripper means 8. In FIG. 2B the condition of said foil hood after reefing onto said gripper means 8 is shown.

In order to now stretch said foil hood 6 in horizontal direction, said gripper means 8 are moved in horizontal direction to the right-hand and/or left-hand sides, respectively. This method step can be seen from FIG. 2C, wherein the movement of said gripper means is indicated by arrows. For avoiding that said foil hood on the corners or the gripper action area is exposed to such strong expansion forces that thin portions are created in the foil which might cause damage of said foil, both rolls 10 of said pushing-on means 9 are moved into the direction opposite to that of the preceding method step, this permitting slow rolling-off of said foil hood during said horizontal stretching operation. Herein it is essential that the speed of said rolls is adjusted such that the rolling-off speed from said gripper means is less than the horizontal speed of said gripper means since otherwise the desired stretch could not be made possible. In total it is achieved by this method step that the horizontal stretch is reduced in controlled manner as controlled to the traditional apparatuses.

After the horizontal stretch having been carried out now said frame is moved vertically in downward direction, wherein said rolls 10 do not carry out a rotational movement until the foil hood touches the upper end of said stack of goods. Said method step can be seen from FIG. 2D.

In FIG. 2E two method steps during pulling-over of said foil hood over said stack of goods are shown, wherein said foil hood is in contact with said stack of goods. As soon as said foil hood touches said stack of goods, beside said vertical movement of said frame a rotational movement of said rolls 10 of said gripper means 8 starts, wherein said roll of said left-hand gripper means rotates in counterclockwise direction and said roll of said left-hand gripper means moves in clockwise direction. By said rotational movement of said rolls rolling-down of said foil hood from said gripper means is controlled and thereby a desired vertical stretch of said foil hood is achieved. The speed of said rolls therein is adjusted such that the rolling-down speed of said foil hood from said gripper means is lower than the vertical speed of said lifting frame since otherwise the desired vertical stretch could not be produced.

FIG. 2F shows the method step finishing said pulling-over operation. After said frame with the respective gripper means is located below the lower end of said stack of goods and said foil hood is rolled down from the respective gripper means to a high degree, the lower end of said foil hood is held on said gripper means in order to thus permit maximum vertical stretch as well as an understretch. Thereby fixed bearing of said lower end of said foil hood on said stack of goods after sliding down from said gripper means is rendered possible.

Therefore, it also is conceivable that said gripper means in case of pressed-on rolls moved towards one another until under said pallet for thereafter completely releasing said foil which already partly moved under said pal-

Variable	Mean	SD	Min	Max	Skewness	Kurtosis	Shapiro-Wilk	Normality
Age	35.2	12.5	18	65	0.15	3.2	0.98	Normal
Gender	1.2	0.4	1	2	0.05	3.5	0.99	Normal
Marital Status	1.8	0.6	1	3	0.10	3.3	0.97	Normal
Education	12.5	2.1	9	16	0.20	3.1	0.96	Normal
Income	3200	1500	1000	8000	0.30	3.0	0.95	Normal
Occupation	2.5	0.8	1	4	0.15	3.4	0.98	Normal
Health Status	1.5	0.5	1	3	0.10	3.3	0.97	Normal
Stress Level	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Life Satisfaction	3.5	1.2	1	5	0.15	3.2	0.98	Normal
Resilience	2.2	0.7	1	4	0.10	3.3	0.97	Normal
Emotional Stability	1.8	0.6	1	3	0.15	3.4	0.98	Normal
Self-Esteem	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Optimism	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Gratitude	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Forgiveness	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Empathy	3.8	1.3	1	5	0.15	3.2	0.97	Normal
Compassion	3.5	1.2	1	5	0.10	3.3	0.98	Normal
Kindness	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Generosity	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Patience	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Humility	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Modesty	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Shyness	2.0	0.7	1	3	0.10	3.3	0.98	Normal
Introversion	1.5	0.5	1	3	0.15	3.4	0.99	Normal
Extroversion	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Social Skills	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Communication	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Teamwork	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Leadership	3.5	1.2	1	5	0.15	3.2	0.97	Normal
Conflict Resolution	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Problem Solving	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Decision Making	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Time Management	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Organization	3.5	1.2	1	5	0.15	3.2	0.97	Normal
Productivity	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Efficiency	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Quality Control	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Attention to Detail	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Focus	3.5	1.2	1	5	0.15	3.2	0.97	Normal
Concentration	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Memory	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Learning Ability	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Adaptability	2.8	0.9	1	4	0.20	3.1	0.96	Normal
Flexibility	3.5	1.2	1	5	0.15	3.2	0.97	Normal
Resilience	3.0	1.0	1	5	0.20	3.1	0.96	Normal
Stress Management	2.5	0.8	1	4	0.15	3.2	0.97	Normal
Emotional Regulation	3.2	1.1	1	5	0.10	3.3	0.98	Normal
Self-Reflection	2.8	0.9	1	4	0.20	3.1	0.96	Normal